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## (54) Preventing corrosion

(57) A hydrazine solution with improved initial activity in relation to oxygen dissolved in water which has been activated by the addition of complexes of trivalent cobalt with inorganic ligands as complex-formers, contains 2-amino-4-nitrophenol and or 2-acetamino-4-nitrophenol as a coactivator.

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## SPECIFICATION

## Process for improving the initial activity of activated hydrazine

5 This invention relates to a process for improving the initial activity of hydrazine in relation to oxygen dissolved in water, the hydrazine being activated by the addition of complexes of trivalent cobalt with inorganic ligands as complex-formers. 5

Activated hydrazine is used as a means for the removal of oxygen from water, particularly from boiler feed water and from water employed for preservation of idle plant, in order to prevent corrosion of tanks, pipes, heat exchangers and other parts. 10

For the removal of oxygen dissolved in water various processes are employed. Preference is given to the use of hydrazine, which even at low temperatures and with the addition of suitable activators, reacts with oxygen dissolved in water to form hydrogen. Cationic and anionic complexes of trivalent cobalt, with inorganic ligands as complex-formers, are proposed as particularly suitable activators (GB ref:39291). Even if these activators are regarded as advantageous, they have a disadvantage in that hydrazine activated in this way does not immediately reach its full reaction speed in relation to oxygen dissolved in water. The drawback may be surmounted either by gasification with air or by the addition of trivalent phenols as coactivators (GB ref:39274). These measures can improve the initial activity provided a relatively high concentration of activator is maintained, amounting to 0.5 to 1 g per litre of commercial hydrazine solution. 15

For special applications, however, these activator concentrations, though satisfactorily effective in themselves, may prove excessive in relation to the oxygen decomposition. 20

This invention seeks to improve the initial activity of activated hydrazine in relation to oxygen dissolved in water and at the same time to reduce the activator concentration required when the activators employed consist of complexes of the trivalent cobalt with inorganic ligands as complex-formers. The object of the invention is to provide a suitable activator system which ensures that hydrazine solution with the said activators in moderate concentration would immediately reach a high reaction speed in relation to oxygen dissolved in water, this process not requiring gasification with air. 25

According to this invention there is provided a process for improving the initial activity in relation to oxygen dissolved in water of hydrazine which has been activated by the addition of complexes of trivalent cobalt with inorganic ligands as complex-formers, in which process the activated hydrazine solution contains 2-amino-4-nitrophenol and/or 2-acetamino-4-nitrophenol as a coactivator. 30

Despite the fact that aminophenols with at least two nitro groups in the molecules are already known as activators, although they have to be used in comparatively high concentrations (DE 2601466), it has been found that neither 2-amino-4-nitrophenol nor a pure acetyl compound is satisfactorily effective when used as an activator. 35

Surprisingly it has been found that aqueous hydrazine solutions when produced in a suitable manner and containing the activators in the form of cationic or anionic complexes of trivalent cobalt with inorganic ligands as complex-formers and at the same time containing small quantities of 2-acetamino-4-nitrophenol or 2-amino-4-nitrophenol as coactivators, develop from the beginning of their action a fully adequate speed for the decomposition of oxygen dissolved in water. This enables the activator content to be reduced to below the value of 0.05 to 0.1% by mass in relation to the aqueous hydrazine solution, which is the usual proportion in this group of substances, with 220 g N<sub>2</sub>H<sub>4</sub>/l. 40

High reaction speeds in relation to oxygen are obtained with hydrazine solutions containing, 0.05 to 0.5 g/l of cobalt complex as an activator and 0.05 to 0.25 g/l of 2-amino-4-nitrophenol or 2-acetamino-4-nitrophenol as a coactivator. With a view to maximum use of metal complex compound, hydrazine solutions containing 0.05 to 0.5 g/l of sodium hexanitritocobaltate (III) and 0.05 to 0.25 g/l of 2-acetamino-4-nitrophenol mixed with 2-amino-4-nitrophenol are particularly suitable. 45

*Example*

50 1 ml of an aqueous hydrazine solution containing 220 g of hydrazine per litre, and with an activator consisting of 0.05 to 0.5 g/l of sodium hexanitritocobaltate (III) or cobalt (III)-hexamminochloride and a coactivator consisting of 0.05 to 0.25 g/l of 2-amino-4-nitrophenol or 2-acetamino-4-nitrophenol or a mixture of both compounds, is added to one litre of oxygenous water with about 6.5 mg O<sub>2</sub>/l, of which the pH value has been set to 10.4, the oxygen decomposition then being measured after 10 minutes. The temperature amounts to 293°K. The following table shows, after a reaction time of 10 minutes, the oxygen decomposition as a percentage in relation to the concentration of activator and of coactivator, compared with values obtained in the presence of only one substance in each case in addition to hydrazine. 55

	$\text{Na}_3\text{Co}(\text{NO}_2)_6$ (g/l)	$\text{Co}(\text{NH}_3)_6\text{Cl}_3$ (g/l)	2-Acetamino- 4-nitrophenol (g/l)	2-Amino- 4-nitrophenol (g/l)	$\text{O}_2$ -Decomposition after 10 minutes (%)	
5	—	—	1	—	13	5
	—	—	0.5	—	9	
	—	—	0.25	—	3	
10	—	—	—	2	12	10
	0.05	—	0.05	—	88	
15	0.1	—	0.1	—	96	15
	0.25	—	0.25	—	97	
	0.5	—	0.25	—	98	
20	—	—	—	—	—	20
	0.1	—	—	0.1	89	
25	0.25	—	—	0.25	100	25
	0.05	—	0.05	0.05	86	
	0.1	—	0.05	0.05	99	
30	—	0.25	—	0.25	100	30
	—	0.25	0.25	—	100	
35	—	0.1	0.05	0.05	89	35
	—	0.05	0.05	0.05	78	
	—	1.6	—	—	70	
40	1.5	—	—	—	62	40

## CLAIMS

- 45 1. Process for improving the initial activity, in relation to oxygen dissolved in water, of hydrazine which has been activated by the addition of complexes of trivalent cobalt with inorganic ligands as complex-formers, in which process the activated hydrazine solution contains 2-amino-4-nitrophenol and/or 2-acetamino-4-nitrophenol as a coactivator.
- 50 2. Process in accordance with Claim 1, wherein the hydrazine solution contains 0.05 to 0.5 g/l cobalt complex as an activator and a mixture of 0.05 to 0.25 g/l 2-amino-4-nitrophenol and 2-acetamino-4-nitrophenol as a coactivator.
3. Process for improving the initial activity of hydrazine in relation to oxygen dissolved in water as described herein and exemplified.